tire left flank. The patient was in shock. Blood transfusions were started, the left groin incision was reopened. A large dissecting pseudo-aneurysm was found originating at the site of the previous arteriotomy along the left superficial femoral artery. The pseudo-aneurysm had dissected subcutaneously over the entire left anterior abdomen and flank. The left common iliac artery was surgically divided and both the proximal and the distal ends were oversewn. The clots from the dissecting hematoma were removed, subcutaneous drains were placed in the left flank and the left groin incision was closed. The procedure was extraperitoneal.

Following this fourth operation the patient responded well. Good arterial supply remained in the left thigh to allow healing of the stump. Discharged on September 20, 1963, the patient then remained in good health.

Comments

The reported mortality from ruptured abdominal aortic aneurysm following operation varies from 34 per cent in one series[2] to 74 per cent in another.[9] Although aneurysmectomy, prosthesis and venorrhaphy of the vena cava are the preferred treatment in this condition,[3] in the present case the anatomical distortion and hemorrhage made vena caval division and ligation necessary. No hypotension ascribable to this procedure was observed.

Certainly one of the known causes for the high death rate in this condition is the development of acute renal failure. Nanson[7] showed that clamping of the abdominal aorta distal to the renal arteries can cause tubular necrosis. Nesbit[8] mentioned that the mortality rate of acute renal failure following prolonged operation approaches 80 to 90 per cent. Barry and associates[1] suggested that acute functional renal failure occurs in all patients undergoing aneurysmectomy.

Both Nesbit and Barry observed that the use of a mannitol infusion early enough can often reverse the process of renal shutdown. This was demonstrated quite dramatically in the present case following the first two operations. Mannitol acts as an osmotic diuretic and is also now thought to increase renal blood flow. Moore[5] recently published a concise review of this subject.

Summary

A case of an abdominal aortic aneurysm with rupture into the inferior vena cava is reported. It is believed to be the fourteenth case successfully treated surgically. Mannitol was used postoperatively for acute renal failure.

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Long Term Local Hypothermia of Gangrenous Extremity

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PATIENTS with gangrenous extremities due to vascular insufficiency are in general in poor physiological condition due to age and the advanced state of the arteriosclerotic disease process. Many have diabetes in addition to the widespread arteriosclerosis.

Dehydration, infection and toxemia from the infection about the gangrenous extremity are usual complications. Not infrequently a thromboembolic

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phenomenon may be the result of a silent myocardial infarction.

In such situations, a stop-gap measure to gain time until the associated or superimposed pathological changes can be corrected or improved will greatly minimize the risk of major surgical procedure and make the operative amputation possible.

Local hypothermia is an excellent means to gain this needed time in which to prepare the patient for amputation. Most gratifying of all is the almost immediate relief from pain when cold is applied.

Rather than regular ice for local hypothermia,[3] we have found dry ice or an electrical hypothermia unit such as that used in cardiovascular procedures to be neater and easier.

First wrapping the gangrenous extremity in sheet wadding, we pack crushed dry ice about it. Then the packed area is wrapped in a rubber sheet and finally in woolen blankets. It is essential that the dry ice does not extend up to or beyond the point of proposed surgical amputation, for it is not intended as an anesthetic agent for surgical amputation as it has been used by other investigators.[1,2] If the extremity is a leg, the wrapping of blankets must be thick enough to prevent the cold from affecting the opposite extremity.

If freezing is felt to be required for an extended period, a hypothermia unit may be used as in the case presented below. In applying the hypothermia unit to the extremity, the latter is snugly fitted with the extremity sleeves of the unit over the leg wrapped in sheet wadding. This is then wrapped well in woolen blankets. The unit is maintained at 30°F and it is checked from time to time at first to make sure it is stabilized at the desired temperature. Further adjustment then is unnecessary. With this method there is no necessity for cumbersome replacement of ice or dressings. And since the extremity is frozen solid, application of a tourniquet beforehand is not required. This prevents the distal engorgement experienced with regular ice cooling.

The longest duration of local hypothermia reported by Moretz and coworkers[3] was 24 days. In the case presented below, hypothermia was continued for 11 weeks. The feasibility of local hypothermia for so long a time was pondered, but circumstances of the occasion made it a necessity.

The patient had no ill effects from the extended freezing of the extremity. The body temperature remained normal once the toxic effects of the gangrenous extremity were controlled. The appetite and sense of wellbeing improved and remained good throughout the freezing period.

There was no necessity for frequent changes of dressings or replenishing of ice. The hypothermia unit was maintained at 30°F and at that temperature the extremity was frozen solid; at any higher temperature there was a tendency for the extremity to thaw and become soft with necrotic degeneration.

The following cases illustrate the use of the hypothermia machine for an extended period.

Reports of Cases

CASE 1. A 57-year-old white man with spastic quadriplegia had sudden onset of pain in the left lower extremity with coldness and cyanotic discoloration from the knee down. Ileofemoral thromboembolism seemed the probable cause. The patient refused operation and the extremity deteriorated rapidly. An electrocardiogram revealed posterolateral myocardial infarction, the probable origin of the embolism.

With rapid deterioration of the extremity, deeper cyanosis and bleb formations, the pain became unbearable. Although the patient's consent for amputation was later obtained, the procedure was out of the question because of the fresh myocardial infarction. Hypothermia was decided upon but because of the anticipation of long term treatment necessitated by the infarction, use of a hypothermia unit rather than dry ice packing seemed advisable. During the time hypothermia was maintained, the patient's cardiac status was followed weekly with electrocardiograms. About the time he was felt to have recovered sufficiently for surgical amputation, new changes in the electrocardiograms were suggestive of extension of the infarction. Finally after 11 weeks of local hypothermia, with improvement in the cardiac condition, an uneventful above-the-knee amputation was carried out with spinal anesthesia. The stump healed without difficulty and the patient did well thereafter.

In three additional cases local hypothermia was maintained by the dry ice technique for from five to 21 days.

CASE 2. Symptoms compatible with a saddle embolus developed in a 50-year-old white woman with diabetes while she was in a coma for two days. Both legs were packed in dry ice for 12 days and bilateral above-the-knee amputation under spinal anesthesia then was carried out. The wound healed without difficulty.

CASE 3. Gangrene and severe pain developed in the right foot of a 67-year-old woman who had diabetes and hypertensive cardiovascular disease and right hemiplegia and aphasia due to cerebrovascular accident. The leg was kept frozen with dry ice for five days before operation. The patient died of cardiac arrest on the operating table. At

postmortem examination a recent myocardial infarction was noted. (A preoperative evaluation for infarction, for which operation had been postponed previously, had been negative.)

CASE 4. Symptoms and findings suggestive of right ileofemoral arterial occlusion developed suddenly in a 76-year-old white woman with hypertensive cardiovascular disease who was in a semicomatose condition. The leg was placed in dry ice for 21 days while aggressive therapy was carried out to improve her general condition. Before the day of anticipated operation, a cough and fever developed and the operation was canceled. The patient died. At autopsy acute congestive heart failure, arteriosclerotic cardiovascular disease and right ileofemoral artery thrombosis were noted.

Summary

Local hypothermia was maintained in gangrenous extremities in four patients while preparation was made for operation. A hypothermia unit was used in one case for 11 weeks before successful amputation and in three others dry ice was used for periods of from five to 21 days.

Among the benefits of hypothermia of the affected limb is almost immediate and then continuous relief of pain while systemic complications of the gangrenous condition and other concomitant disease are being overcome to prepare the patient for amputation.

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